MODIS QUARTERLY REPORT: SEP/27/96 — DEC/31/96

Radiative Transfer Based Synergistic MODIS/MISR Algorithm for the Estimation of Global LAI & FPAR

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The objective of our effort is to develop a radiative transfer based synergistic algorithm for the estimation of global leaf area index (LAI) and fraction of photosynthetic active radiation absorbed by vegetation (FPAR) from atmospherically corrected MODIS and MISR spectral reflectance data. The algorithm consists of a main procedure (Look-up-table or LUT) and a back-up procedure (using Vegetation Indices or VI). A comprehensive three-dimensional radiative transfer model for vegetated surfaces is utilized by both the procedures to estimate LAI and FPAR fields. The algorithm requires a land cover classification that is compatible with the radiative transfer model. The following is a brief description of our activities for the fourth quarter of 1996 (September through December).

Most of the modelling effort during this quarter was focussed on land cover types where explicit shadowing between crowns is an important physical phenomenon. These cover types include shrublands and forests (both broadleaf and needleleaf). Mutual shadowing between tree crowns enters the formulation through the bidirectional gap probability (BDGP) function. We are adapting a formulation of BDGP originally developed by Nilson into our radiative transfer model. A preliminary version has been included. Future work includes testing of this formulation with a Monte Carlo method and/or alternative methods (eg. the model of Li and co-workers).

A detailed response to the SWAMP review of MODIS LAI/FPAR product was prepared. This included extensive calculations and preparation of new evidence to support our response to the SWAMP review. This response was made available along with the revised ATBD submitted to the Project Office at the end of October 1996.

The MODIS LAI/FPAR ATBD was completely rewritten and submitted to the Project for the December ATBD review. This latest version of the ATBD will soon be made available on the WEB.

A paper describing the back-up MODIS LAI/FPAR algorithm has been accepted for publication in IEEE Transactions on Geoscience and Remote Sensing. The paper describes the algorithm, sensitivity analysis, error budgets and several example results. We analysed 10 years of NOAA AVHRR Pathfinder 8 km NDVI data to derive monthly fields of LAI and FPAR.

As part of the above mentioned paper, we derived a six biome land cover classification that is compatible with the radiative transfer model used for MODIS LAI/FPAR estimations. This classification was derived from NOAA Pathfinder 8 km channel data.

A simplified LUT has been created and we are currently investigating optimal store/search routines. The dependency between the accuracy of retrieval and LUT architecture is being investigated. There was a suggestion at the December ATBD review to try to develop the synergistic MODIS/MISR LUT algorithm for implementation at launch. We are attempting to meet this goal.